high mutation probabilities have the high probabilities in both directions; that is, we ought frequently to see very hairy mutants in the present-day population.

An alternative explanation of the loss of inessential characters may be that every character requires metabolic energy to develop and maintain it, and elimination of a useless character diverts this energy to uses that promote survival, so that individuals without the character survive and reproduce at higher rates than individuals who have it.

Glass hypothesizes that baldness is a product of civilization (and hats), since "baldness is still limited almost entirely to males who have passed the age at which most males, in primitive times, would have died of various causes." The real criterion is whether baldness (and the selective disadvantage which it brings to the individual) occurs prior to *reproduction* (not death). Since baldness only rarely, even today, occurs prior to reproduction, there is no reason to suppose that primitive man lacked the baldness genes, unless complicating pleiotropic effects are postulated.

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References

1. E. Mayr, *Animal Species and Evolution* (Harvard Univ. Press, Cambridge, 1963), p. 207.
2. For example, R. A. Fisher, *Genetical Theory of Natural Selection* (Clarendon, Oxford, 1929); T. Dobzhansky, *Evolution, Genetics, and Man* (Wiley, New York, 1955), p. 152ff.

In arguing that by adopting clothing man "changed his environment sufficiently to make hairiness an inconsequential feature except on the more exposed parts of his anatomy," and further that "head hair, so clearly a protection from sun, wind, and rain has been retained," Glass states the conventional view of the role of hair in man. Evidence is accumulating that this is an unnecessarily limited view of the part hair plays in human and mammalian physiology, indeed that protection from the elements is probably a minor function. Work done in our laboratory and others indicates that hair, as an appendage of the integument, acts with the integument in the management of certain physiological processes, one of which is the highly selective excretion of trace elements. This appears to be true not only of hair in mammals but of feathers in birds and the cast skins of reptiles, amphibians, and arthropods.

Patterns of hairiness in man may follow evolutionary changes in diet or other factors. Baldness itself seems to be associated with increased hairiness over other parts of the body. Hairiness and feather dress is only poorly correlated with severity of climate; tropical mammals and birds have luxuriant hair and feathers. Hence it is reasonably clear that one must be cautious in assigning simple evolutionary roles to hair and similar integumentary derivatives.

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. . . Hair was developed by our earliest mammalian ancestors, probably in the Triassic period, about 200 million years ago. It was part of the temperature regulating mechanism which differentiates mammals from cold-blooded animals and which also includes such components as sweat glands, vasoconstriction and vasodilation, hair erection, panting, shivering, and temperature sensors in various parts of the body. Loss of fur or body hair in man can only be interpreted as due to a mutation involving a defective gene, similar to that responsible for albinism, for example. Because all living men, of all races, now carry this defective gene, we are forced to assume that its introduction into our makeup occurred further back than the development of the genes which serve to distinguish the Caucasian, Negro, Mongoloid, and Pigmy races from each other. The introduction of the gene could hardly have taken place later than the first great dispersion of paleolithic man, which is assumed to have taken place during the great interglacial stage (Yarmouth or Riss-Mindel) about 200,000 years ago. The carriers of the defective gene could hardly have survived except in a highly favorable environment where exposure to cold, mosquitos, sunburn, and spiny vegetation was not too severe a handicap. It is likely, for example, that the Neanderthal race had a heavy coat of fur, because they lived in, and seemed to prefer, an arctic or subarctic environment, which would be fatal to modern man without specialized clothing.

Unless there were some compelling advantage in not having body hair, it would be very unlikely for the defective gene to propagate rapidly throughout a population. The fact that it did, and that all nonbearers of the gene were eliminated completely, requires an explanation. One such possibility will occur to those who have read *Rats, Lice, and History* by Hans Zinsser. Body hair offers exceptional shelter for such insects as ticks and body lice, which have evolved in company with man and other mammals. The nonhairy members of the population probably took great pains to rid themselves of these unwelcome guests, as they still do. Their furry cousins probably never could delouse or detick themselves (as anyone can appreciate who has tried to rid a long-haired dog of ticks). Thus an outbreak of typhus, spotted fever, Black Death, or any similar plague could have wiped out the entire fur-bearing segment of the human population. This could have occurred in a small, compact group of our ancestral humans, while nonancestral groups like the Neanderthalers remained unaffected.

Lack of body hair was unquestionably a compelling incentive for inventing clothing, building shelters, and using fire. The need to compensate for a defective gene may thus have been one of nature's most powerful stimulants for the advancement of mankind.

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On Being Referred To

With the continuing growth of science, problems of communications are increasing greatly. At present there is no practical way to keep up to date with who is referring to one's work. A scientist should know immediately what applications are being made of his work and what interpretations and correlations with other work are being made by others. Timely knowledge of this sort would stimulate new ideas and research, open new channels of collaboration, avoid duplication of effort, and give one the opportunity to defend his work against unjust criticism. Cooperation among scientists, as proposed below, should do much to improve communications.

I propose the adoption of three professional courtesies by the scientific community. First, I suggest that, when preparing papers for publication, authors notify the senior author of each reference cited by postcard. Second, I recommend sending reprints to all authors cited. Third, whenever they send reprints, I suggest that the authors include a mimeographed list of all their previous publications in the field, with asterisks by papers of particular note. Nothing is more frustrating than to be criticized through ignorance of one's own previous work. Such a list would increase the probability of the recipient finding and reading the author's early papers and important papers and of referring to them in his next publication.

In order to achieve immediate benefit from these professional courtesies, I further suggest that investigators review their publications in the last five years and notify authors cited, and finally that publishers include in their instructions a reminder to authors to notify authors cited.

If these professional courtesies become accepted, I believe that the interchange of ideas and information among scientists would be greatly facilitated, duplication of effort reduced, and disputed points between different schools of thought resolved more quickly.

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Observations on Observational and Other Astronomy

K. S. Thorne's article "gravitational collapse and the death of a star" [*Science* **150**, 1671 (1965)] forms a good illustration of whither science is going and indicates a change which, to us old-timers, is not an improvement. The author starts off by saying, "What is the fate of a star. . . ? This is a question which observational astronomy has done but little to answer . . ." and he then continues, "Despite the paucity of observational data, theoreticians are now able. . . ." Since Thorne admits that, theoretically, there are no equilibrium configurations for dead stars containing more than 1.2 times as many baryons as the sun, that such objects must collapse into a singularity, and that the prospect for observing these is nil, it is hardly fair to blame the observers for not having observed them, and I shall confine my remarks to the dead start of smaller mass.

Having spent more than 40 years trying to find faint stars with large motions, largely for the dual purpose of determining the luminosity function and of finding more white dwarfs—the dying stars of which Thorne speaks—I can only marvel at the author's disregard of what observational astronomy has accomplished. I have found and published data on more than 1300 white dwarfs; Greenstein, using the 200-inch telescope, has done a great deal of very important work on the spectra of the brighter specimens. But don't the theoreticians realize (i) that probably at least half the white dwarfs now known are too faint for spectroscopic observations, even with the 200-inch telescope, and (ii) that to obtain spectra for the other half would probably tie up the 200-inch telescope for the equivalent of several full years, as well as a similar 200-inch in the Southern Hemisphere—which we haven't got yet? Most astronomers think there are a few other problems in observational astronomy that deserve the attention of the 200-inch.

Thorne says that "Astronomical measurements of the masses and radii of radiating white dwarfs are in fairly good agreement with the predictions. . . ." The proper way to state this would be to say that present theoretical predictions are in fairly good agreement with the observed masses—the mass of Sirius B having been known for more than 50 years. No radii have ever been observed; they are calculated from the assumed laws of radiation.

Finally, in a discussion of the central densities of white dwarfs, neutron stars, and so on, the curves drawn are continued to 10^{22} g/cm^3, and in the text the discussion of the theoretical singularities resulting from supernova explosions of massive stars is continued to densities of 10^{49}, beyond which the admission is made that theory is "far from completion." Since we are now talking about nuclear densities of the order of 10^{14} to 10^{15}, these new values represent extrapolations by factors of at least 10^7 to 10^{34}. This brings to mind William Whewell's comment: "The cultivation of ideas is to be conducted as having for its object the connexion of facts; never to be pursued as a mere exercise of the subtlety of the mind, striving to build up a world of its own, and neglecting that which exists about us. For, although man may in this way please himself, and admire the creations of his own brain, he can never, by this course, hit upon the real scheme of nature." This was used as